

Ch 9 Stoichiometry AF/H

Q

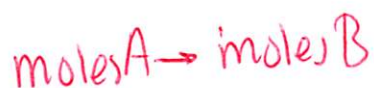
↳ mass relationships between reactants + products in rxns

Greek Stoicheon - element metron - measure

Can do many types of ~~rxn~~ calculations



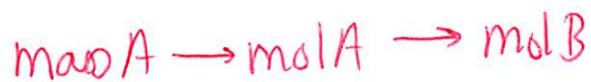
mole-mole problems



mole-mass



mass-mole



mass-mass



~~Atk~~

HMWK Ch 9 pg 265, Q4; 271, Q1, 3, 5 p 278 Q3, 4

AF

pg 279 Q5, 8, pg 280 Q14, 18, 20

p 281 App Prob 3, 8

H pg 280 11, 12, 13, 18

p 281 Q22

mol ratio

(2)



$$\frac{2 \text{ mol Al}_2\text{O}_3}{4 \text{ mol Al}} = \frac{1}{2} \text{ } \left. \begin{array}{l} \text{or reciprocal} \\ \text{of each} \end{array} \right\}$$

$$\frac{2 \text{ mol Al}_2\text{O}_3}{3 \text{ mol O}_2} \quad \rightarrow \quad \frac{4 \text{ Al}}{3 \text{ O}_2}$$

Knowing this if I have 13.0 mol of Al_2O_3 how many of O_2 ?

$$13.0 \text{ mol Al}_2\text{O}_3 \times \frac{3 \text{ mol O}_2}{2 \text{ mol Al}_2\text{O}_3} = 19.5 \text{ mol O}_2$$

If you know the ratio, you can do anything

Stoichiometric calculations

$$\begin{array}{l} \text{mole-mol} \\ \text{mol} \rightarrow \text{mol B} \rightarrow \text{mol A} \times \frac{\text{mol B}}{\text{mol A}} = \text{mol B} \end{array}$$



How many mol of LiOH react w/ 20 mol CO_2 ?

Next do ~~mole~~-mass, mass-mol, mass-mass
all ex

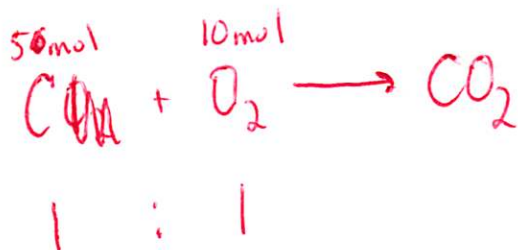
9.3 Limiting Reactant

↳ Reactant that controls amount of product formed in rxn
excess reactant → reactant that is not used completely in rxn

Use air plane analogy

400 people + 350 seats

In the rxn



5 mol excess of O_2

How to determine limiting reactants

Given amounts of 2 reactants A + B, which is limiting

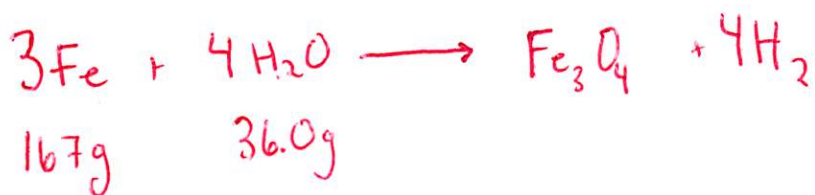
1. Use A to find # of mol of A ~~you~~ you have.

2. Find mol B that mol A needs to react w/.

3. Compare mol B needed w/ mol B you have.

4. If you have more B than needed A is limiting
~~more~~ less B " " B " "

Rxn Ex Rxn



- a. what is the limiting reagent?
b. how much excess is left?
c. how much Iron Oxide produced?

a. $167\text{g} \times \frac{1\text{ mol}}{55.8\text{g}} = 2.99\text{ mol Fe} \times \frac{4\text{ mol H}_2\text{O}}{3\text{ mol Fe}} = 3.99\text{ mol H}_2\text{O} \times \frac{18\text{ g}}{\text{mol}} = 71.8\text{g H}_2\text{O}$

Have 2.99 mol Fe, for this req 3.99 mol H₂O (71.8 g H₂O)

only have 36.0 g H₂O therefore H₂O is limiting.

Fe is excess.

b. to do this must calculate # mol of H₂O

$$36.0\text{g} \times \frac{1\text{ mol}}{18\text{g}} = 2\text{ mol of H}_2\text{O} \times \frac{3\text{ Fe}}{4\text{ H}_2\text{O}} = 1.5\text{ mol Fe} \times \frac{55.8\text{g Fe}}{\text{mol}} = 83.7\text{g Fe needed.}$$

$$167\text{g} - 83.7\text{g Fe} = 83.3\text{g left.}$$

c

$$2\text{ mol H}_2\text{O} \times \frac{1\text{ Fe}_3\text{O}_4}{4\text{ mol H}_2\text{O}} \times \frac{231.4\text{g}}{\text{mol}} = 116\text{g Fe}_3\text{O}_4 \text{ made.}$$

% Yield, Theoretical yield, Actual Yield

Theoretical yield \rightarrow max amount of product ~~calculated~~ that can be ~~theoretically~~ obtained in a rxn (mathematically determined).

Actual yield \rightarrow actual amount of product obtained in a rxn (experimentally observed)

$$\text{Percent yield} \rightarrow \frac{\text{actual}}{\text{theoretical}} \times 100\%$$



Find % yield.

1st
Theoretical $36.8\text{g} \times \frac{1\text{ mol}}{78.1\text{g}} \times \frac{1\text{ mol C}_6\text{H}_5\text{Cl}}{1\text{ mol C}_6\text{H}_6} \times \frac{113\text{g C}_6\text{H}_5\text{Cl}}{\text{mol C}_6\text{H}_5\text{Cl}} = 53.2\text{g C}_6\text{H}_5\text{Cl}$

$$\% = \frac{38.8\text{g}}{53.2\text{g}} \times 100\% = 72.9\%$$